NAVAJO NATION YEAR 2000
SURFACE WATER QUALITY ASSESSMENT:

CHINLE CREEK/ CHINLE WASH WATERSHED
(HUC# 14080204)

PREPARED BY:

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CHAPTER 1: INTRODUCTION

1.1. PURPOSE OF REPORT

The Federal Clean Water Act (CWA) establishes a process by which states, territories, and Native American tribes report on the quality of the Nation's water resources to the U.S. Environmental Protection Agency (USEPA), U.S. Congress, and the general public (NNEPA 1997). The CWA requires states to submit biennial water quality assessments in the form of Section 305(b) reports to USEPA. Native American tribes, while not required to report on the quality of tribal water resources, are encouraged to submit Section 305(b) reports as well. USEPA then compiles the data from state, territory, and tribal reports to provide summaries to U.S. Congress. Section 207 of the Navajo Nation Clean Water Act states that the Navajo Nation Environmental Protection Agency (NNEPA) may prepare water quality reports consistent with the requirements of CWA Section 305(b) (NNEPA 1999a). The main reason to prepare regional and nationwide water quality assessments is to determine if the nation's waters are supporting various uses, such as fishing and swimming. These assessments provide information in support of watershed and environmental policy decision making and resource allocation at the local and national level (NNEPA 1997).

The Navajo Nation Environmental Protection Agency Water Quality/ NPDES Program (NNEPA WQ) has previously prepared a variety of reports that provide information on water quality on the Navajo Nation (NNEPA 1997, 1998a, 1998b, 1998c, 2000a). NNEPA WQ prepared and submitted a CWA Section 305(b) report in 1997 (NNEPA 1997). The determination of use support in the 1997 report was based primarily on qualitative evaluations due to the lack of ambient quantitative monitoring data at that time. As NNEPA WQ has grown, we have been able to collect additional ambient monitoring data, and have begun to expand our monitoring efforts into biological and habitat measurements as well.

To be consistent with surrounding state and tribal programs, and to continue developing the emphasis on watershed-scale assessments, this report focuses on the Chinle watershed (Hydrologic Unit Code [HUC] #14080204). The purpose of this report is to compare all readily available and reliable Chinle watershed water quality data to the Navajo Nation Water Quality Standards (NNWQS) in order to determine whether surface waters are meeting their designated uses. This reporting format is consistent with NNEPA WQ's long-term monitoring plan as detailed in the Watershed Monitoring Strategy for Surface Water Quality Monitoring and Assessment (NNEPA 2000b). This report format was also designed to be compatible with Section 305(b) reporting formats by providing the following information:

- a characterization of Chinle watershed surface water resources and an assessment of surface water quality;
- an evaluation of the extent to which Chinle watershed surface waters support aquatic life, wildlife, and recreational uses;
- a description of stressors and potential sources of surface water pollution and of programs for surface water pollution control; and
- an indication of progress toward meeting surface water quality standards and goals, and recommendations for further action.

This report format is also designed to be compatible with the development of our Watershed Protection Program. This report will be submitted to affected chapters, the Navajo Nation Council, USEPA, and other interested parties. This report will be presented to schools, council committees, chapters, and other Navajo Nation departments upon request. This 305(b)-style report may be combined with reports covering other watersheds at some point in the future to produce a comprehensive 305(b) report.

1.2. PROGRAM HISTORY AND CURRENT STATUS

The Navajo Environmental Protection Commission was established in 1972. In 1995, the Navajo Nation Council passed a resolution establishing the Navajo Nation Environmental Protection Agency (NNEPA) and approved adoption of the Navajo Nation Environmental Policy Act. This legislation made NNEPA a separate regulatory branch of the Navajo Nation government, charged with protecting human health, welfare, and the environment of the Navajo Nation. The mission of NNEPA is as follows:

> *With respect to Din4 values, protect, preserve, and enhance public health, welfare, and the environment for present and future generations by developing, implementing, and enforcing strong environmental laws, and to foster public awareness and cooperation through education and motivation.*

The 1987 Amendments to the CWA allow Native Americans to receive "treatment as a state." This enables the Navajo Nation to apply for and receive CWA funding to protect its water resources. In 1993, NNEPA WQ was formed and began receiving CWA Section 106 funds to monitor and assess surface waters of the Navajo Nation. The mission of NNEPA WQ is to ensure that the waters of the Navajo Nation attain, support, and maintain their respective designated uses. The guiding phrase of NNEPA WQ is *Tó be' ii na* (Water is life). The primary objectives of NNEPA WQ are to:

- assess the quality of the "Waters of the Navajo Nation;"
- determine the attainable designated uses of waters throughout the Navajo Nation, including domestic water supply, primary human contact, secondary human contact, agricultural water supply, cold water habitat, warm water habitat, ephemeral warm water habitat, and livestock/ wildlife watering;
- develop water quality management plans and best management practices (BMPs) to maintain or improve present uses and allow for additional uses where possible;
- ensure compliance and provide information regarding CWA Section 401 certification and 404 permitting to all entities implementing project activities that effect waters of the Navajo Nation; and
- provide education to the general public, schools, tribal officials, federal agencies and industry related to factors affecting water quality and the values and function of wetlands.

NNEPA WQ has grown since its inception in 1993, particularly since the 1997 CWA 305(b) report was prepared. Our ambient monitoring efforts have increased along with development and implementation of watershed restoration CWA Section 319(h) grants. We have also begun coordinating volunteer monitoring efforts with local schools, Dine' College, Northern Arizona University, and the Nature Conservancy.

Given the size of the Navajo Nation compared to other Native American lands, the Navajo Nation plans to apply for specific CWA Section 106 yearly target funding for consistent, adequate, yearly CWA funds which would be similar to a state allocation. Currently, NNEPA competes yearly with all other tribes for CWA allocations.

1.3. Brief Overview of Navajo Nation Surface Waters

The Navajo Nation is situated on the Colorado Plateau. Plateau-like features generally characterize the topography 4,000-7,000 feet in elevation (NNEPA 1997). Navajo Mountain; Defiance Plateau; the Carrizo, Chuska, and Zuni Mountains; and the northern part of Black Mesa rise above 8,000 feet. The canyons of the Colorado River and the Little Colorado River dip below 3,000 feet. Annual precipitation ranges from six inches in both Bisti Badlands and the Little Colorado Valley to twenty-four inches in the Chuska Mountains.

Biotic communities vary widely according to precipitation, elevation, and soil type (NNEPA 1997). Lower, middle, and higher elevations are comprised of Great Basin Desertscrub, Great Basin Conifer Woodlands, and Petran Subalpine and Montane Conifer Forests, respectively. A large portion of the Navajo Nation is also comprised of Plains and Great Basin Grasslands, found on high, level plains; and Subalpine Grasslands, which occupy valleys, slopes, and ridges on flat or undulating terrain in the vicinity of Subalpine Conifer Forests.

The Navajo Nation includes portions of three major river basins: Upper Colorado, Lower Colorado, and Rio Grande. These regions are further divided into five subregions and thirty-three cataloging units (USGS 1987). Twenty-seven of these 8-digit hydrologic unit codes (HUCs) are scheduled to be monitored by the year 2004 as detailed in Section 2.2 below. A current effort is underway to delineate these 8-digit watershed further into 10- and 12-digit watersheds (personal communication, Dino Desimone, Natural Resource Conservation Service, AZ).

The majority of surface waters flowing within or originating from the Navajo Nation are either intermittent or ephemeral. Exceptions include the Colorado and San Juan Rivers, McElmo Creek, the groundwater-fed streams of the Navajo-Glen Canyon area, the lower part of the Chinle Wash, the Chuska Mountains-Defiance Plateau area, and portions of the lower part of the Little Colorado River and Moenkopi, Dinnebito, Oraibi, and Pueblo Colorado Washes (Cooley et al 1969).

Because the annual average precipitation is less than one-third of the rate of evaporation from open water surfaces, the Navajo Nation contributes little to its perennial rives. For example, the Navajo Nation contributes less than two percent of total San Juan River flow even though 56 percent of the basin is within the Navajo Nation (WBEC 1976). The greatest surface water potential exists primarily in the Chuska Mountains and Defiance Plateau areas, and where water-bearing units are able to control and maintain perennial flow (WBEC 1976). Table 1 provides a summary of Navajo Nation population and stream statistics (NNEPA 1997).

Table 1. Navajo Nation population and stream statistics.

CATEGORY	VALUE
Surface Area	17,627,262 ac (27,543 sq. mi.)
Total Population 1996 (NNDCD 1997)	**172,399**
• Western Navajo Agency	36,927
• Chinle Agency	25,952
• Fort Defiance Agency	45,908
• Shiprock Agency	29,529
• Eastern Navajo Agency	34,083
Total miles of rivers and streams	**39,184**
• Miles of perennial rivers/ streams	1,042
• Miles of intermittent/ ephemeral rivers/ streams	38,142
• Miles of ditches and canals	364
• Border miles of shared rivers/ streams	*ca* 250
• Miles of rivers and streams currently with designated uses	2,265

From NNEPA 1997.

There are several reservoirs on the Navajo Nation that provide storage for irrigation water, recharge to the alluvial systems that the recharge domestic water supply, critical wildlife habitat, and recreation (NNDWR 2000). Table 2 lists fishing lakes and reservoirs of the Navajo Nation per the Navajo Department of Fish and Wildlife (NNDFW) Fishing and Boating Regulations (NNDFW 1998). Several of the outlet works at the reservoirs are in disrepair, and are currently under-going restoration efforts by the Navajo Nation Safety of Dams program.

Table 2. Fishing lakes and reservoirs on the Navajo Nation.

NAME	ESTIMATED SURFACE AREA (ACRES)	NAME	ESTIMATED SURFACE AREA (ACRES)
Antelope Lake	9	Morgan Lake	1228
Asaayi Lake[1]	37	Red Lake	502
Aspen Lake	9	Round Rock Lake	84
Berland Lake	8	Trout Lake	9
Chuska Reservoir	83	Tsaile Lake[1]	260
Cow Springs Lake	na	Wheatfields Lake[1]	218
Cutter Dam Reservoir	104	Whiskey Lake	100
Ganado Lake	335	White Mesa Lake	na
Many Farms Lake[1]	1600		

From NNDWR 2000 and NNEPA 1997. na = not available

[1] Note: Currently have Navajo Nation-assigned designated uses (NNEPA 1999b).

Additional summary data on cultural and traditional aspects of water, wetlands and riparian areas, and groundwater can be found in the CWA 1997 305(b) summary report (NNEPA 1997).

CHAPTER 2: WATER QUALITY STANDARDS, MONITORING, AND ASSESSMENT

2.1. CURRENT STATUS OF NAVAJO NATION WATER QUALITY STANDARDS

The Navajo Nation Clean Water Act (NNCWA) and Navajo Nation Water Quality Standards (NNWQS) were developed and approved by council resolutions in 1999 (NNEPA 1999a, NNEPA1999b). The NNWQS list various surface waters of the Navajo Nation and their current designated uses. Each designated use has an associated list of water quality standards (i.e., water quality parameter maximum or minimum limits) that must be obtained if the water is to meet its designated use(s). Every three years, the NNWQS will be reviewed, revised, and presented to the public for comment in order to 1) keep current with the latest scientific/toxicological research, 2) add waters previously not listed, 3) add additional monitoring criteria such as biological and physical, and 4) delete or add designated uses to specific waterbodies as warranted.

NNEPA WQ is in the final stages of receiving authorization from USEPA to administer certain components of the Clean Water Act. USEPA has received a Navajo Nation program authorization application for CWA Section 303 (Water Quality Standards) and Section 401 (Certification) programs. USEPA opened their required 30-day comment period on December 28, 2000, through public notice in the Navajo Times newspaper. The CWA Section 402 (NPDES Permitting) Navajo Nation application will be processed once the Section 303 and 401 applications are approved.

There are currently eight designated uses defined in the Navajo Nation Water Quality Standards (NNEPA WQ 1999b). "Aquatic, Wildlife, and Livestock Numeric Surface Water Standards" cover the following uses:

CwHbt **Cold Water Habitat**: Water body supports the use of the water by animals, plants or other organisms, including salmonids, for habitation, growth or propagation. Water body supports or is capable of supporting cold water fishes, including trout species, and the aquatic community upon which they depend. Fish recovered from waters designated as cold water habitats shall be fit for human consumption. Cold waters are waters that typically have temperatures below 20 ^{o}C.

WwHbt **Warm Water Habitat**: Water body supports the use of water by animals, plants or other organisms, excluding salmonids, for habitation, growth or propagation. Warm water bodies support or are capable of supporting warm water fishes, including bass species, catfish species, and bluegill species, and the aquatic community upon which they depend. Fish recovered from waters designated as warm water habitats shall be fit for human consumption. Warm waters are waters that typically have temperatures exceeding 20 ^{o}C.

EphWwHbt **Ephemeral Warm Water Habitat**: Water body supports the use of an ephemeral warm water by animals, plants or other organisms, excluding fish, for habitation, growth or propagation.

L&W **Livestock and Wildlife Watering**: Water body supports use of the water by livestock and/or by non-domestic animals (including migratory birds) for consumption (ingestion), habitation, growth and/or propagation.

"Human Health and Agriculture Numeric Surface Water Standards" cover the following uses:

Dom **Domestic Water Supply**: Water body supports use of the water as a potable water supply.

PrHC **Primary Human Contact**: Water body supports the use of the water that causes the human body to come into direct contact with the water, typically to the point of submergence in the water body, or probable ingestion of the water, or contact by the water with membrane material of the body. Examples include ceremonial uses, swimming and water-skiing.

ScHC **Secondary Human Contact:** Water body supports the use of the water which may cause the water to come into direct contact with the skin of the body, but normally not to the point of submergence, ingestion of the water, or contact of the water with membrane material of the body. Such contact would occur only incidentally. Examples include ceremonial and other cultural uses, boating and fishing.

AgWS **Agricultural Water Supply**: Water body supports the use of the water for the irrigation of crops which could be used for human consumption.

The following Human Health criteria, where listed, also apply:

Consumption of Organisms Only: Human health criteria applicable to all surface waters containing aquatic organisms used for human ingestion.

Consumption of Water and Organisms: Human health criteria applicable to all surface waters used as a domestic water supply. In the event a compound has numeric surface water quality standards for both Domestic Water Supply designated use *and* Consumption of Water and Organisms, the more stringent of the two numerical standards shall apply.

Narrative standards are non-numeric values developed to ensure the following (NNEPA 1999b):

All Waters of the Navajo Nation shall be free from pollutants in amounts or combinations that, for any duration:

1. Cause injury to, are toxic to, or otherwise adversely affect human health, public safety, or public welfare.

2. Cause injury to, are toxic to, or otherwise adversely affect the habitation, growth, or propagation of indigenous aquatic plant and animal communities or any member of these communities; of any desirable non-indigenous member of these communities; of waterfowl accessing the water body; or otherwise adversely affect the physical, chemical, or biological conditions on which these communities and their members depend.

3. Settle to form bottom deposits, including sediments, precipitates and organic materials, that cause injury to, are toxic to, or otherwise adversely affect the habitation, growth, or propagation of indigenous aquatic plant and animal communities or any member of these communities; of any desirable non-indigenous member of these communities; of waterfowl accessing the water body; or otherwise adversely affect the physical, chemical, or biological conditions on which these communities and their members depend.

4. Cause physical, chemical, or biological conditions that promote the habitation, growth, or propagation of undesirable, non-indigenous species of plant or animal life in the water body.

5. Cause solids, oil, grease, foam, scum, or any other form of objectionable floating debris on the surface of the water body; may cause a film or iridescent appearance on the surface of the water body; or that may cause a deposit on a shoreline, on a bank, or on aquatic vegetation.

6. Cause objectionable odor in the area of the water body.

7. Cause objectionable taste, odor, color, or turbidity in the water body.

8. Cause objectionable taste in edible plant and animal life, including waterfowl, that reside in, on, or adjacent to the water body.

Biological criteria are under development. Narrative biocriteria will be added during the next triennial review. Numeric biocriteria are ecoregion specific and relies on correct characterization of the reference conditions. As such, numeric biocriteria will take several years to develop.

2.2. SURFACE WATER QUALITY WATERSHED MONITORING STRATEGY

Monitoring is a critical component in the cycle of assessment, development, implementation, and revision of water quality standards. During FY2000, we revised and refined our monitoring strategy in order to move towards a more comprehensive assessment of tribal waters (NNEPA 2000b).

A *watershed* is an "area of land that drains water, sediment, and dissolved materials to a common outlet at some point along a stream channel" (Dunne and Leopold 1978). Water quality in streams and lakes reflects the geologic and vegetative condition of their watershed, as well as landuse activity. Geology, climate, vegetation, and water quantity, among other things, vary widely across the Navajo Nation.

Assessments at a watershed level enable NNEPA WQ to prioritize streams in need of restoration. Given the size of the Navajo Nation, NNEPA WQ does not have enough personnel, time, or funds to sample all surface waters at all times. NNEPA WQ, therefore, developed a long-term plan for monitoring and assessing all surface waters on the Navajo Nation (NNEPA 2000b). Monitoring sites will include watershed-specific sites, long-term trend stations, reference sites, and special project sites.

- **Watershed-Specific Sites**

Watershed-wide assessments, based on a variety of monitoring techniques, will identify which specific waters are and are not meeting their assigned designated uses. Since watersheds can be defined at several different scales, NNEPA WQ decided to major watersheds classified by U.S. Geological Survey eight-digit Hydrologic Unit Codes (HUCs) for planning purposes (USGS 1987). To maximize the quality and quantity of data used to assess surface waters, a five-year rotating schedule was developed to enable NNEPA WQ to intensively monitor and characterize select watersheds each fiscal year. The breakdown is based on several factors, including number of perennial waters and location within major river basins. The proposed watershed schedule for the next five years is shown in Table 3 and Figure 1. The fiscal year, October 1 to September 30, is the same as the "water year."

Table 3. NNEPA WQ watershed sampling schedule.

WATERSHED(S)	8-DIGIT HUC(S)	APPROX. AREA ON NAVAJO NATION (MI. SQ.)	FISCAL YEAR
Chinle Wash	14080204	4,181	2000
Upper San Juan River	14080101	412	2001
Blanco Canyon	14080103	282	
Middle San Juan River	14080105	1,077	
Chaco Wash	14080106	4,501	
Mancos River	14080107	64	
Lower San Juan – Four Corners	14080201	903	
McElmo Creek	14080202	66	
Montezuma Creek	14080203	89	
Middle Little Colorado River	15020008	495	2002
Corn-Oraibi Wash	15020012	459	
Polacca Wash	15020013	519	
Jeddito Wash	15020014	637	
Canyon Diablo	15020015	121	
Lower Little Colorado River	15020016	1,218	
Dinnebito Wash	15020017	356	
Moenkopi Wash	15020018	1,985	
Zuni River	15020004	521	2003
Upper Puerco River	15020006	1,756	
Lower Puerco River	15020007	527	
Leroux Wash	15020009	607	
Cottonwood Wash	15020011	1,400	
Rio Puerco	13020204	129	
Arroyo Chico	13020205	534	
Rio San Jose	13020207	341	
Rio Salado	13020209	95	
Lower Lake Powell	14070006	1,504	2004
Lower San Juan River	14080205	1,526	
Lower Colorado – Marble Canyon	15010001	371	

The sampling objective is to accurately characterize ambient watershed conditions and to determine if assigned designated uses are being achieved. These sites will be monitored a

minimum of twice per year (quarterly if funds and staff time allow) for the field and lab general water chemistry, nutrients, total and dissolved metals, and bacteria. Radionuclides, organic pollutants, and/or other parameters may be added to the sample suite on a case-by-case basis, depending on landuse in the watershed and surrounding area. Yearly benthic macroinvertebrate monitoring will be added to perennial sites as our bioassessment program develops. NNEPA water quality stations sampled each year that are not in the watershed(s) scheduled to be sampled that year will be listed, but not analyzed, in yearly summary reports for future reference (see Appendix A).

- **Long-Term Trend Stations**

  These fixed stations will be established in various locations across the Navajo Nation to determine trends in water quality. Trend sites will be chosen to be representative of water quality throughout a stream, lake, or watershed. These sites will be monitored a minimum of twice per year (quarterly if funds allow). The same constituents listed for watershed-specific sites will be sampled at long-term trend stations.

- **Reference Sites**

  These bioassessment long-term sites will be used to characterize least-disturbed conditions on a regional scale. These sites may be defined by elevation, ecoregions, or geological condition instead of watershed boundaries. Reference sites will be monitored during spring and fall index periods for two years in order to determine the most critical season. After the two-year study period, reference sites will be sampled during the index period when the differences between reference sites and impacted sites are easiest to discern.

- **Special Project Sites**

  These sites will be selected to evaluate such things as BMP effectiveness, permit compliance, water quality complaints, Total Maximum Daily Load (TMDL) studies, anti-degradation analyses, and standards development. Sample frequency and parameters monitored will depend on the sampling objectives and funding level of each specific project.

2.3. DATA MANAGEMENT AND QA/QC PROTOCOLS

NNEPA WQ's monitoring program follows accepted protocols for sample collection, sample handling, field and data analysis, quality assurance/quality control (QA/QC) issues, data management, and reporting. NNEPA WQ has developed a database for tracking all water quality data by the program. This database currently uses the Microsoft® Access software program. NNEPA WQ will continue to collate and incorporate non-NNEPA data as separate tables in the master ACCESS database. The source of data used to assess water quality will be identified in each record in the database and clearly indicated in assessment reports. Primary non-NNEPA sources of data include USEPA, United States Geological Survey (USGS), the U.S. Bureau of Reclamation (BOR), the National Park Service (NPS), the Bureau of Indian Affairs (BIA), and various Navajo Nation Departments.

All chemical, biological, and physical measurements are taken and processed in accordance with a Quality Assurance Project Plan (QAPP) in order to assure precision, completeness, representativeness, and comparability of data. In February 1995, USEPA approved the NNEPA's QAPP for chemical assessment of water quality in streams (NNEPA 1995). In FY2001, NNEPA will develop quality assurance and quality control systems to better develop the program's technical capacity, including re-development of the QAPP. A technically defensible QAPP is essential in order to meet the requirements of CWA Sections 201 and 207. The revised QAPP will reflect changes in data quality objectives, sampling procedures, data review, data reduction, and corrective actions. Additions will include the incorporation of groundwater and lake sampling protocols. The lake protocol will take into account trophic environments and distinguish between depth-specific and limnological sampling approaches. In November 2000, USEPA approved the NNEPA WQ's QAPP for benthic macroinvertebrate bioassessments in wadeable streams (NNEPA 2000c). The contents of this QAPP, including physical habitat monitoring procedures, will also be included in the FY2001 QAPP revisions in order to generate one comprehensive QAPP document.

2.4. Assessment Categories and Use Support Determinations for Streams

Use support determinations can be determined using a variety of information and data. This section provides detailed information of how NNEPA will determine use support for streams. Lake and other water body use determinations have different requirements, which will be developed in future assessment reports as monitoring data becomes available. NNEPA distinguishes between assessments based on sufficient monitoring data and assessments based on insufficient monitoring data as detailed in Table 4.

Table 4. Definition of evaluated vs. monitored assessments.

Type of Assessment (Code)	Use support decision based on…
Evaluated (EVAL)	• Information other than current site-specific ambient data, such as data on landuse, location of sources, predictive modeling, and/or questionnaires from fish and game biologists; or • Ambient data greater than 5 years old[1]; or • Other reliable information concerning non-compliance with narrative standards.
Monitored (MON)	• Current, site-specific, ambient monitoring data, generally sampled at least during two different flow conditions per year, and believed to accurately portray water quality conditions; or • Data from more than one data type (i.e., physical/chemical, bioassessment, habitat, toxicological) for aquatic use determinations.

Based on ADEQ 2000 and USEPA 1997.

[1]NOTE: If old ambient data exists for high-quality waters located in remote areas with no known pollutant sources, and if those data are believed to accurately portray water quality conditions, those waters could be considered "monitored."

Assessment data is used to determine the level of use support of a given waterbody based on its designated uses. Possible degrees of use support are defined in Table 5.

Table 5. Degrees of use support.

USE SUPPORT LEVEL (CODE)	GENERAL DESCRIPTION
Full Support (FULL)	• Good water quality • Not/least impaired
Partial Support (PART)	• Fair water quality • Moderately impaired
Non-Support (NON)	• Poor water quality • Severely impaired
Additional determinations: Full Support but Threatened (THRN)	• No impairment indicated by all data types but with a declining trend in water quality over time • Data indicate WQ problem that requires further information
Not assessed (NA)	• Non-evaluated due to lack of sufficient information/data

Based on MDEQ 1999 and USEPA 1997.

2.4.1. Aquatic, Wildlife, and Livestock Beneficial Use Determinations:

Aquatic, wildlife, and livestock beneficial use designations are broad and intended to protect aquatic plants, fish, and invertebrates, as well as wildlife and livestock that consume surface waters and adjacent vegetation. In order to holistically assess aquatic, wildlife, and livestock use attainment, NNEPA WQ is moving towards a more comprehensive approach that incorporates data from a variety of data types and assessment approaches. The four broad categories of data types/assessment approaches are defined in Table 6.

Table 6. Categories of data types/assessment approaches for Aquatic, Wildlife, and Livestock Use determinations.

DATA TYPE/ASSESSMENT APPROACH	GENERAL DESCRIPTION
Bioassessment (BIO)	• Includes chlorophyll *a* data; aquatic biological assemblage data such as fish, benthic macroinvertebrates, and algae; and wildlife community characteristics
Habitat assessment (HAB)	• Includes qualitative and/ or quantitative riparian and aquatic vegetation information, and fluvial geomorphic characteristics and functions
Toxicological (TOX)	• Includes bioassays, acute and chronic whole effluent toxicity (WET) tests, and acute and chronic sediment testing
Physical/ chemical (CHEM)	• Includes temperature, total suspended solids, ionic strength (pH), dissolved oxygen, turbidity, nutrients, and toxicants (e.g., metals, organics, radionuclides, pesticides)

Based on MDEQ 1999 and USEPA 1997.

Data must be sufficient and credible in order to evaluate whether or not a waterbody is attaining its designated uses. Biological, habitat, chemical, and toxicological assessments need to be integrated in order to make aquatic life use determinations. An integrated approach must consider assessment quality as indicated by levels of information of the different data types in evaluating the degree of use support when there are differences in assessment results (USEPA 1997).

A hierarchy of methods corresponding to each data type and ordered by level of information is displayed in the tables in Appendix B (USEPA 1997). Data are evaluated to determine if they are

sufficient and credible for making beneficial use-support decisions based on the data's technical components, spatial/temporal coverage, and data quality (precision and sensitivity). Level 4 represents the highest quality and provides a relatively high level of certainty. Level 1 represents less rigorous approaches and provides lower levels of certainty. The level of each data type per stream segment assessment will be documented in use support assessment summary tables. This information will be useful in identifying data gaps for monitoring planning purposes.

A low level of assessment quality will be adequate in situations where conditions are severe and overwhelming evidence exists. For example, a site with repeated fish kills or severe sedimentation from mining can be characterized as impaired with a high level of confidence based on a cursory survey of biota or habitat.

Once the levels of available data have been determined, the data is used to make aquatic use support decisions. Table 7 was developed for making aquatic life use support decisions for streams (modified from MDEQ 1999 and USEPA 1997).

Table 7. Aquatic life use support decision criteria for streams (CwHbt, WwHbt, EphWwHbt, L&W).

DATA TYPE/ ASSESSMENT APPROACH	FULL SUPPORT	PARTIAL SUPPORT	NON-SUPPORT
Biological [1]	• Reliable data indicate functioning, sustainable biological assemblages (e.g., fish, macroinvertebrates, or algae) not modified significantly beyond the natural range of reference condition (> 75% of reference condition).	• At least one biological assemblage (e.g., fish, macroinvertebrates, or algae) indicates moderate impairment when compared to reference condition (25 to 75% of reference condition).	• At least one biological assemblage (e.g., fish, macroinvertebrates, or algae) indicates severe modification of the biological community when compared to reference condition (< 25% of reference condition).
Habitat[1]	• Data indicate natural channel morphology, substrate composition, bank/riparian structure, and flow regime of region. • The stream has riparian vegetation of natural[2] types with minimal short-term impacts. • Measurements indicate that the stream geomorphology is similar to reference condition.	• Modification of habitat slight to moderate with some evidence of watershed erosion. Channel modification slight to moderate. • Limited riparian zone due to encroaching landuse patterns; increasing encroachment of undesirable, non-indigenous species. • Measurements indicate that the stream geomorphology is moderately unstable.	• Moderate to severe habitat alteration by channelization and dredging, bank failure, heavy watershed erosion, or alteration of flow. • Removal of riparian vegetation widespread; substantial encroachment of undesirable, non-indigenous species. • Measurements indicate that the stream is extremely unstable (Type F, G, or D).[3]
Toxicological	• Bioassay test indicates there is no acute or chronic toxicity.	• Bioassay test indicates chronic toxicity, but no acute toxicity.	• Bioassay test indicates acute toxicity.

Modified from ADEQ 2000, MDEQ 1999, and USEPA 1997.

[1]Note: Reference condition may use a combination of the following: least-impaired stream, historical data, upstream/ downstream, paired watershed, review of existing literature, and/or expert opinion.
[2]Note: Natural vegetation may include desirable, non-indigenous species.
[3]Note: From Rosgen 1996.

Table 7 (cont.). Aquatic life use support decision criteria for streams.

DATA TYPE/ ASSESSMENT APPROACH	FULL SUPPORT	PARTIAL SUPPORT	NON-SUPPORT
Physical/chemical			
•**Non-toxic parameters**[4] (e.g., pH, temp, DO, cond, TDS)			
A) 1 to 10 samples	**A**) For any one pollutant or stressor, criteria exceeded in no measurements.	**A**) For any one pollutant or stressor, criteria values exceeded in one or more measurements by ≤50%.[5]	**A**) For any one pollutant or stressor, criteria values exceeded in one or more measurements by >50%.[5]
B) > 10 samples	**B**) For any one pollutant or stressor, criteria exceeded in ≤10% of measurements.	**B**) For any one pollutant or stressor, criteria exceeded in 11 to 25% of measurements.	**B**) For any one pollutant or stressor, criteria exceeded in > 25% of measurements.
•**Toxic substance** (e.g., priority pollutants, metals)			
A) 1 to 10 samples	**A**) For any one pollutant, acute and/or chronic criteria exceeded in no measurements; and/or chronic values are exceeded by < 10%.	**A**) For any one pollutant or stressor, acute criteria values exceeded in one or more measurements by ≤25%; or chronic values are exceeded by 10-50%.[5]	**A**) For any one pollutant or stressor, acute criteria values exceeded in one or more measurements by > 25%; or chronic values are exceeded by 50%.[5]
B) > 10 samples	**B**) For any one pollutant, no more than 1 exceedance of acute or chronic criteria; and/or chronic values are exceeded by <10%.	**B**) For any one pollutant, acute or chronic criteria exceeded more than once, but in ≤ 10% of samples. [5]	**B**) For any one pollutant, acute or chronic criteria exceeded > 10% of samples. [5]
• **Nutrients, turbidity, total suspended solids**[6]	• Measurement values are similar to reference condition.	• Measurement values are moderately higher than reference condition.	• Measurement values are substantially higher than reference condition.

Modified from ADEQ 2000, MDEQ 1999, and USEPA 1997.

[4]Note: Biases in DO and temperature sampling (such as diurnal flux) should be considered.
[5]Note: Discretion in choosing partial or non-support based on number of samples and magnitude of exceedences.
[6]Note: Reference condition may use a combination of the following: least-impaired stream, historical data, upstream/ downstream, paired watershed, review of existing literature, and/or expert opinion.

When data are available from more than one data type/assessment approach, the data must be integrated in order to make an aquatic life use determination. NNEPA WQ will consider the level of information of the different data types in evaluating degree of use support. In general, assessments based on data with high levels of information will be weighed more heavily than those

based on data with low levels of information. However, a stream segment cannot receive a full support use designation if any one data type indicates impairment (USEPA 1997).

Biological data, when available, will be weighed more heavily than other types and could be the basis for determining partial vs. non-support. Biological data provide a direct measure of the status of the aquatic biota. Bioassessments can also detect the cumulative impact of multiple stressors on the aquatic community, including new or previously undetected stressors (USEPA 1997). Figure 2 details the process of integrating different data types.

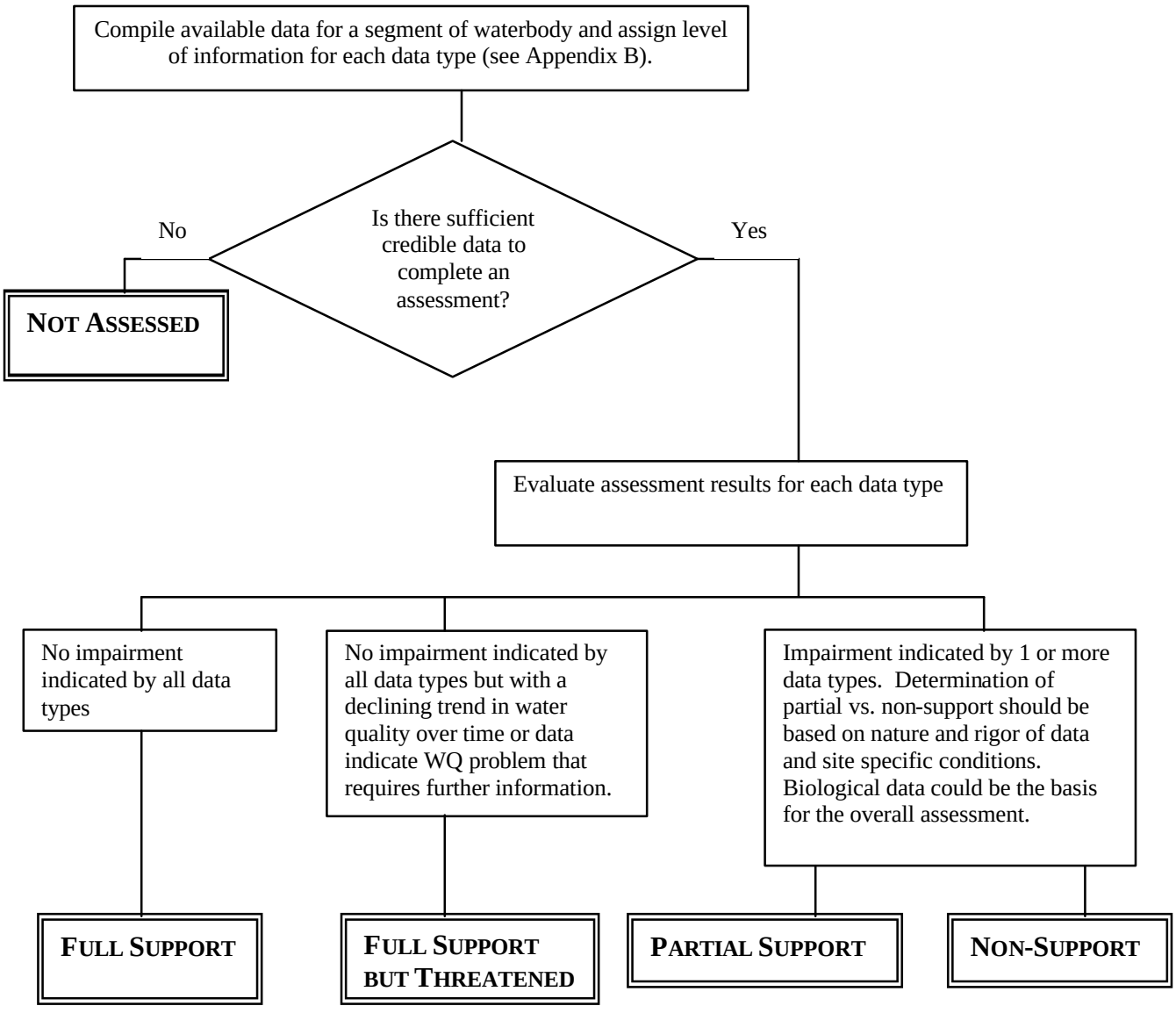

Figure 2. Determination of aquatic use support using different data types (modified from USEPA 1997).

2.4.2. Human Health and Agriculture Use Determinations:

For domestic water, contact recreation, and agricultural uses, evaluation of multiple data types is not necessary. Human health and agriculture use determinations are therefore more of an independent evidence test than a weight-of-evidence test. The level of data available, however, should be labeled as either "insufficient" or "sufficient" based on the data's technical components, spatial/ temporal coverage, and data quality (precision and sensitivity) (see Appendix C).

Making use support determinations for human health and agriculture uses is relatively straightforward. Available data for a given water body are compared to associated standards, and an overall use-support decision is made based on consideration of all the criteria for which data are available and sufficient. Table 8 was developed for making human health and agriculture use determinations in streams.

Table 8. Human Health and Agriculture Use support decision criteria for streams (PrHC, ScHC, Ag).

BENEFICIAL USE	FULL SUPPORT	PARTIAL SUPPORT	NON-SUPPORT
Drinking water (DOM)	• No human health standard exceedences.	• Not applicable.	• Exceedence of human health standard.
Fish Consumption (Consumption of Organisms Only)	• No restrictions or advisories in effect.	• Restricted consumption advised.	• Fish consumption not recommended; or median of all samples exceeds standard. [1]
Contact Recreation[2] **(PrHC, ScHC)**	• For any one pollutant or stressor, criteria exceeded in ≤10% of measurements. • Fecal coliform geometric mean not exceeded, and ≤10% of single samples taken during 30-day period exceeded standards.	• For any one pollutant or stressor, criteria exceeded in 11 to 25% of measurements. • Fecal coliform geometric mean exceeded only once, or >10% of single samples taken during 30-day period exceeded standards.	• For any one pollutant or stressor, criteria exceeded in >25% of measurements. • Fecal coliform geometric mean repeatedly exceeded.
Agriculture (Ag)	• For any one pollutant or stressor, criteria exceeded in ≤10% of measurements. • Specific conductance is <1500 umhos/cm.	• For any one pollutant or stressor, criteria exceeded in 11 to 25% of measurements. • Specific conductance is 1500 to 7500 umhos/cm.	• For any one pollutant or stressor, criteria exceeded in >25% of measurements. • Specific conductance is > 7500 umhos/cm.

Modified from ADEQ 2000, MDEQ 1999, and USEPA 1997.

[1] Note: Must have more than two samples to compute median.
[2] Note: NNEPA will be switching over to *E. coli* standards during the next triennial review.

CHAPTER 3: CHINLE WATERSHED ASSESSMENT

3.1. LOCATION AND POLITICAL BOUNDARIES

The Chinle watershed (HUC# 14080204) is located in the San Juan River Basin, in the north-central portion of the Navajo Nation interior (Figure 3). The majority of Chinle watershed is in Arizona, with small portions being in New Mexico and Utah. Chinle watershed includes portions of the Arizona/New Mexico Plateau, Arizona/New Mexico Mountains, and Colorado Plateau ecoregions (Omerik 1987). The entire Chinle watershed is within the boundary of the Navajo Nation. The Navajo Nation is politically divided into 5 agencies, which are further divided into a total of 110 chapters. The Chinle watershed includes portions of 18 chapters and 4 agencies. Table 9 lists estimated 1997 populations. The estimated 1997 population in Chinle watershed was 30,676. The largest population centers are Chinle, AZ, and Kayenta, AZ.

Table 9. Chinle watershed population centers.

COMMUNITY/ TOWN	EST. 1997 POPULATION
Chinle	8,116
Crystal	818
Chilchinbito	1,296
Dennehotso	1,696
Kayenta	5,928
Lukachukai	2,276
Many Farms	2,309
Mexican Water	584
Nazlini	1,185
Rough Rock	1,132
Round Rock	857
Sweetwater	1,291
Tsaile/Wheatfields	1,596
Tselani	1,592
TOTAL	***30,676***

From NNDCD 1997.

There are two national monuments in the Chinle watershed: Canyon de Chelly National Monument near Chinle, AZ; and Navajo National Monument near Kayenta, AZ. The legislation authorizing the monuments assigns primary responsibility for the management of cultural resources, administration, and visitor services facilities to the National Park Service. The Navajo Nation retains the control of the land and natural resources, and is responsible for surface and subsurface uses of the land.

3.2. CLIMATE AND SURFACE HYDROLOGY

Chinle watershed includes portions of the Chinle Valley, Defiance Plateau, and Chuska Mountain USGS physiographic provinces (NNEPA 1997). These provinces are delineated based on the occurrence of groundwater and surface water, and physiographic conditions such as geology and altitude.

The Navajo Nation Department of Water Resources (NNDWR) maintains a network of weather stations in the Chinle watershed, including snow courses, recording rain gages, raincans, and full weather stations (Figure 4). The National Weather Service maintains weather stations at Canyon de Chelly Headquarters and Lukachukai, AZ (Table 10).

Table 10. Average monthly and average annual minimum, maximum, and mean precipitation and temperature values for 1967 to 1997 (NWS station #21248 Canyon de Chelly)

MONTH	MIN PRECIP (INCHES)	MAX PRECIP (INCHES)	MEAN PRECIP (INCHES)	MIN TEMP (°F)	MAX TEMP (°F)	MEAN TEMP (°F)
Jan	0	5.6	0.74	17.89	43.71	30.82
Feb	0	2.0	0.61	23.39	51.39	37.41
Mar	0	2.1	0.69	28.93	59.62	44.30
Apr	0	2.9	0.54	34.60	68.19	51.42
May	0	2.4	0.58	42.72	77.45	60.18
Jun	0	2.1	0.33	50.91	87.99	69.47
Jul	0	3.4	1.11	58.88	91.55	75.24
Aug	0.3	4.8	1.31	57.94	88.84	73.41
Sept	0	2.2	0.94	48.99	82.17	65.61
Oct	0	4.5	1.0	36.69	70.29	53.52
Nov	0	2.2	0.83	26.62	55.69	41.18
Dec	0	2.7	0.74	18.09	44.65	31.39
Average Annual Values	**3.3**	**18.0**	**9.51**	**37.05**	**68.51**	**52.83**

According to USEPA Reach File One, there are 40 lakes and 3,583 total stream miles in Chinle watershed, 663 of which are perennial (USEPA 2000). There are currently 18 stream segments and 3 lakes with designated uses in Chinle watershed (NNEPA 1999b).

NNDWR currently maintains five continuous stream gages in the watershed. The Chinle gage at Chinle, AZ, and the Lukachukai gage are currently maintained by the USGS per a cooperative agreement starting FY2000. USGS maintains two other active stations, and has records on two discontinued stations (Black Mountain Wash near Lukachukai, AZ, and Lukachukai Creek Tributary Near Lukachukai, AZ) in the basin. Recent streamflow statistics are presented in Table 11.

Table 11. Summary of recent historic streamflow at active NNDWR and USGS gages

STATION NAME (USGS GAGE NUMBER)	DRAINAGE AREA (MI2)	WATER YEAR(S)	MIN MEAN DAILY FLOW (CFS)	MAX MEAN DAILY FLOW (CFS)	AVERAGE MEAN DAILY FLOW (CFS)
Chinle Creek at Chinle, AZ[1,2] (09379025)	639	1997 1998 1999	0 0 0	490 505 574	38.3 39.1 25.7
Chinle Creek near Mexican Water, AZ[2] (09379000)	3,650	1996 1997 1998 1999	0 0 0 0	610 1590 560 838	7.58 31.1 22.0 31.0
Laguna Creek at Dennehotso, AZ[2] (09379180)	undetermined	1997 1998 1999	0 0 0	623 514 563	11.4 5.77 8.34
Lukachukai Wash above Round Rock Diversion, AZ[1,2] (09379050)	92.0	1996 1997 1998	0 0 0	40 139 200	0.92 3.09 3.28
Tsaile Creek above Tsaile Lake[1]	48.2	1997 1998	0.68 1.50	55 150	7.57 12.1
Wheatfields Creek above Wheatfields Lake[1]	27.4	1997 1998 1999	0.73 0.59 0.70	66 146 42	7.32 8.40 2.31
Whiskey Creek north of Little White Cone, AZ[1]	33.0	1999	0.38	6.8	2.38

[1] Note: USGS cooperator station
[2] Note: NNDWR station

3.3. LANDUSE AND WATER USE

Primary landuses in the watershed include ranching, farming, mineral extraction, silviculture, and recreation. There are no major industrial facilities in Chinle watershed. Livestock grazing occurs throughout the basin, causing upland and streambank erosion and subsequent streambed sedimentation (NNEPA 1998a). Grazing is primarily open-range within the watershed based on historic grazing permits passed down through the generations. Riparian vegetation and bank stability are heavily impacted throughout the watershed as a result of open-range grazing.

There are several agricultural plots scattered throughout the watershed. The irrigation infrastructure, which exists primarily near Wheatfields, Tsaile, Crystal, Lukachukai, Tohtso, Nazlini, and Many Farms, is in various states of repair. Irrigation infrastructure in Canyon del Muerto is no longer functioning due to channel downcutting and undersized diversions and grade control structures (NRCS 2000).

There are several small abandoned uranium mines scattered predominantly in the northeastern boundary of Chinle watershed, near Lukachukai, Hasbidito, and Walker Creeks. Uranium mining potentially contributed sediment, turbidity, suspended and dissolved solids, trace elements, and radionuclides to water resources (NNEPA 1997). Uranium mining was active during the Cold War nuclear arms buildup. There are currently no active uranium mining operations in Chinle watershed.

The upper perennial reaches in the eastern portion of the basin are within the Navajo Nation commercial forest boundary. Under the National Indian Forest Resources Management Act, the Bureau of Indian Affairs (BIA) is responsible for timber management on Indian lands, either directly or through contracts with tribes under Public Law 93-638 as amended (NNFD and BIA 2000). The Navajo Nation Forestry Department (NNFD) currently contracts a number of forest activities, while BIA manages, funds, and oversees these activities. Timber was first harvested from the Navajo forest in the late 1800s. Lumber was used to build schools, administration buildings, and homes. As early as 1894, small quantities of lumber were made available to off-reservation buyers. Between 1962 and 1992, timber was sold to Navajo Forest Products Industry (NFPI), a tribally owned entity that operated the sawmill in Navajo, NM. In 1994, environmental organizations filed suit against BIA, claiming that BIA violated the Endangered Species Act (ESA) by failing to consult with U.S. Fish and Wildlife (USFWS) regarding the effects of forestry management actions on the endangered Mexican Spotted Owl and its habitat. In 1995, Arizona Federal District Court issued a ruling against BIA, stating that the BIA could not allow any timber sales until a new Forest Management Plan had been developed and reviewed by USFWS to ascertain whether requirements of the ESA would be met. A Forestry ID Team was formed that drafted a Programmatic Environmental Impact Statement / Navajo Ten-Year Forest Management Plan Alternatives (NNFD and BIA 2000). The Navajo Nation Council has not completed review of this plan at this time.

Adverse impacts to cold water fisheries associated with logging include, but are not limited to, increased water temperature, reduced dissolved oxygen, and increased sedimentation. Construction and poor maintenance of forest roads can result in up to 90% of all sediment produced from forest activities (NNFD and BIA 2000). Many old logging roads, skid trails, and landings are sources of sediment throughout the Navajo Forest.

Concentrated recreation takes place at Canyon de Chelly National Monument, Navajo National Monument, Tsaile Lake, and Wheatfields Lake. Tsaile Lake, Wheatfields Lake, and Many Farms Lake are open 24-hours per day to fishing. There is also a camping/picnic area at Wheatfields. Tsaile Lake and Wheatfields Lake are restricted to electric trolling motors or hand trolling devices (NNDFW 1998). There are no motor size restrictions at Many Farms Lake. The Navajo Nation Department of Fish and Wildlife (NNDFW) has stocked certain species in the lakes over the years. Table 12 lists fish species in the lakes as of 1998 (NNDFW 1998).

Table 12. Fish in Chinle watershed lakes with designated uses

LAKE	HABITAT DESIGNATION	FISH SPECIES
Many Farms	Warmwater	Channel catfish, largemouth bass, bluegill, carp
Tsaile	Coldwater	Rainbow trout, brown trout, cutthroat trout, channel catfish
Wheatfields	Coldwater	Rainbow trout, brown trout, cutthroat trout, brook trout

Recreational fishing also occurs on an infrequent basis in various streams in Chinle watershed. Non-salmonid bluehead mountain sucker and speckled dace are native to these streams. The U.S. Fish and Wildlife Service (USFWS 1982) stocked Tsaile Creek with rainbow trout in 1955, 1958, and 1961. Stocking was discontinued after 1961 due to habitat degradation from man-made barriers (i.e., road culverts) and continued heavy livestock use. Livestock trampling in and around the stream had

caused heavy siltation over the ideal gravel, rock, and boulder stream bottom necessary for salmonid cover and shelter. Only bluehead mountain sucker and speckled dace were found during the 1982 Tsaile Creek survey (USFWS 1982).

Whiskey Creek was stocked with brown trout and rainbow trout between 1953 and 1973 (USFWS 1975). Brown trout, rainbow trout, speckled dace, and bluehead mountain suckers were found in a 1975 USFWS survey. The biologists involved with this survey noted no evidence of natural brown trout reproduction between the last stocking date (1973) and the survey date (1975). The authors concluded that serious soil erosion had taken place throughout the watershed as a result of timber harvest operations, logging roads, excessive grazing in the riparian area, and heavy snowmelt run-off. They noted that virtually no forest or range reclamation work had been undertaken to prevent future watershed deterioration. Only bluehead mountain sucker and brown trout were found during the 1982 Whiskey Creek survey (USFWS 1982).

The stocking history of Wheatfields Creek was not documented in the 1982 study (USFWS 1982). Cutthroat trout, rainbow trout, speckled dace, bluehead mountain suckers, fathead minnow, and rainbow-cutthroat hybrid were found during the 1982 survey. The authors noted that although Wheatfields Creek had the most potential for salmonid fisheries development, siltation from then-present landuse practices was limiting salmonid reproduction (USFWS 1982).

Stocking of streams no longer occurs on the Navajo Nation by either the USFWS or NNDFW. The stocking of non-native species such as rainbow trout has altered the biological conditions of many streams in the west. Monitoring data from a watershed restoration study at Asaayi Creek indicated that as the population of non-native rainbow trout increased, the population of native speckled dace decreased (NNDWR 1999). No bluehead mountain suckers were found in the Asaayi survey. These non-salmonids are very sensitive to the presence of non-native species such as rainbow trout because bluehead mountain suckers are good forage for trout. Non-native rainbow trout need adequate pool-riffle habitat for survival, while native specked dace and bluehead mountain sucker prefer more riffle-run habitat.

There are seven NPDES-permitted wastewater treatment (WWTF) facilities in Chinle watershed, located at Chinle, Kaibito, Kayenta, Rough Rock, Nazlini, Crystal, and Many Farms. Chinle WWTF and Kayenta WWTF discharge continually and are major facilities, based on population served. There are also several sewage lagoons near smaller communities.

Public water supply, domestic use, livestock use, and irrigation use are the primary ground and surface water uses in Chinle basin, based on a 1990 USGS report (USEPA 2000). The estimated 1990 per capita domestic water use was 118 to 125 gallons per day. Table 13 breaks down primary ground and surface water uses.

Table 13. Chinle watershed average daily ground and surface water uses (1990).

CATEGORY	GROUNDWATER USE (MGAL/D)[1]	SURFACE WATER USE (MGAL/D)[1]	TOTALS
Public-supplied domestic	1.63	0	1.63
Self-supplied domestic	1.77	0	1.77
Livestock use	0.17	0.07	0.24
Irrigation use	0.64	1.24	1.88
Totals	4.21	1.31	5.52

From USEPA 2000.
[1]Note: Mgal/D = Million Gallons per Day

3.4. CHINLE WATERSHED SURFACE WATER ASSESSMENT

All NNEPA-collected surface water quality data collected between 1995 and 2000 was analyzed to determine use support based on the procedure detailed above in Section 2.4. STORET data for Chinle basin was also downloaded and analyzed for exceedences. Benthic macroinvertebrate sampling began fall of 2000, based on our approved QAPP (NNEPA 2000c). Qualitative and quantitative habitat data was collected at the time of the benthic sampling. The fall 2000 benthic macroinvertebrate samples have not been processed as of this writing and, therefore, cannot fully be used for this Chinle surface water assessment.

The results of the Chinle surface water assessment are displayed in Table 14 by NNWQS designated water bodies. Undesignated stream reaches Wheatfields Creek and Tohtso Creek were also added to the assessment. Supporting data for the Chinle assessment can be found in Appendix D.

Twenty-three total water bodies were analyzed for use attainment. Using the guidelines in Section 2.4, the use support breakdown is as follows: zero full support, nine partial support, one non-support, eleven not assessed (due to lack of sufficient credible data), and two not applicable (due to no current use designations). Primary stressors include turbidity, fecal coliform, temperature, and dissolved oxygen. Potential sources of these stressors include upland and riparian grazing, paved and unpaved roads, unimproved stream crossings, past silviculture, and exotic species. Previous NNEPA reports based on qualitative assessments have also determined partial support of coldwater, warmwater, and ephemeral warmwater habitat designated uses in Chinle watershed tributaries because of sediment and pathogen contributions from grazing, sediment contributions from timber harvesting and roads associated with timber harvesting, and sediment contributions from other unpaved roads (NNEPA 1997, NNEPA 1998a).

The following nine stream segments were determined to **partial support** their respective designated uses:

- Chinle Creek/ Chinle Wash, mouth to mouth of Canyon de Chelly – NNEPA has two water quality monitoring stations on this main stem stream. The use support assessment was based on limited physical/chemical and habitat data, as reflected in the data levels. Turbidity and fecal coliform values exceeded PrHC, ScHC, and EphWwHbt standards. Also, a riparian study classified two perennial sections of this stream as being in poor to fair condition with highly eroded banks, little riparian vegetation, and little chance of recovery without major restoration work (AGFD 1996).

Table 14. Chinle watershed streams assessment (supporting data is in Appendix D).

WATERBODY NAME SEGMENT WATERBODY SIZE	DESIGNATED USES * = INDICATES IMPAIRMENT	USE SUPPORT (ASSESSMENT CATEGORY)	DATA LEVEL (SEE APPENDIX B AND C; 0 = NO DATA, 1= LOW, 4= HIGH) C = PHYSICAL/CHEMICAL B = BIOASSESSMENT H = HABITAT ASSESSMENT T = TOXICOLOGICAL	USE SUPPORT STRESSOR(S)	POTENTIAL SOURCES OF STRESSOR (S)	ASSESSMENT COMMENTS
Balakai Wash, mouth to headwaters 19.4 miles	ScHC EphWwHbt L&W	Not Assessed	C0, B0, H1, T0		Rangeland, riparian grazing, road construction.	No new information since 1997 CWA 305(b) report (see NNEPA 1997).
Black Mountain Wash, mouth to headwaters 16.6 miles	ScHC EphWwHbt L&W	Not Assessed	C0, B0, H1, T0		Rangeland, land disposal, riparian grazing, road construction.	No new information since 1997 CWA 305(b) report (see NNEPA 1997).
Canyon de Chelly Wash, mouth to mouth of Coyote Wash 27 miles	PrHC ScHC EphWwHbt L&W	Not Assessed	C0, B0, H1, T0		Rangeland, riparian grazing, unimproved stream crossings.	No new information since 1997 CWA 305(b) report (see NNEPA 1997).
Canyon del Muerto Wash, mouth of Canyon de Chelly to Tsaile Lake 18 miles	PrHC ScHC AgWS EphWwHbt L&W	Not Assessed	C0, B0, H1, T0		Rangeland, riparian grazing, unimproved stream crossings.	No new information since 1997 CWA 305(b) report (see NNEPA 1997).
Chinle Creek/ Chinle Wash, mouth to mouth of Canyon de Chelly 89.3 miles	PrHC* ScHC* AgWS EphWwHbt* L&W	Partial (Evaluated)	C1, B0, H1, T0	Turbidity Fecal Coliform	Rangeland, riparian grazing, unimproved stream crossings in Canyon de Chelly National Monument, unpaved roads	
Cottonwood Wash, mouth to headwaters 21.0 miles	ScHC EphWwHbt L&W	Not Assessed	C0, B0, H1, T0		Exotic species, rangeland, riparian grazing.	No new information since 1997 CWA 305(b) report (see NNEPA 1997).
Coyote Wash, mouth to headwaters 18.6 miles	ScHC* EphWwHbt* L&W	Partial (Evaluated)	C2, B0, H1, T0	Turbidity Fecal Coliform	Rangeland, riparian grazing, unpaved roads.	
Laguna Creek, nonperennial reaches, mouth to headwaters (miles included below)	ScHC EphWwHbt* L&W	Partial (Evaluated)	C1, B0, H1, T0	Turbidity Temperature	Rangeland, riparian grazing, lack of riparian vegetation for shade, exotic species.	

Table 14 (cont). Chinle watershed streams assessment (supporting data is in Appendix D)

WATERBODY NAME SEGMENT WATERBODY SIZE	DESIGNATED USES * = INDICATES IMPAIRMENT	USE SUPPORT (ASSESSMENT CATEGORY)	DATA LEVEL (SEE APPENDIX B AND C; 0 = NO DATA, 1= LOW, 4= HIGH) C = PHYSICAL/CHEMICAL B = BIOASSESSMENT H = HABITAT ASSESSMENT T = TOXICOLOGICAL	USE SUPPORT STRESSOR(S)	POTENTIAL SOURCES OF STRESSOR (S)	ASSESSMENT COMMENTS
Laguna Creek, perennial reaches, mouth to headwaters 48.8 miles	PrHC* ScHC* AgWS WwHbt* L&W	Partial (Evaluated)	C1, B0, H1, T0	Turbidity Fecal Coliform	Rangeland, riparian grazing.	
Lukachukai Wash, nonperennial reaches, mouth to headwaters (miles included below)	ScHC* EphWwHbt* L&W*	Non-support (Evaluated)	C1, B0, H1, T0	Gross Alpha Turbidity Fecal Coliform Aluminum, Dissolved	Rangeland, riparian grazing, natural sources (radon), abandoned uranium mines scattered throughout watershed.	Gross alpha was detected 1 of 1 times in a small tributary to Lukachukai Wash in amounts that exceed the L&W standards. Aluminum was lab filtered due to excessive turbidity.
Lukachukai Wash, perennial reaches, mouth to headwaters 32.1 miles	Dom PrHC* ScHC* AgWS CwHbt* L&W	Partial (Evaluated)	C2, B0, H1, T0	Turbidity Temperature DO Fecal Coliform	Rangeland, riparian grazing, lack of riparian vegetation for shade, paved and unpaved roads.	Domestic water supply was included as a designated use because some locals collect from tributary waterfall. Three fecal coliform samples from this tributary yielded no exceedences.
Many Farms Lake 1604 acres	PrHC, ScHC AgWS WwHbt, L&W	Not Assessed	C0, B0, H1, T0		Rangeland, habitat modification, land disposal.	No new information since 1997 CWA 305(b) report (see NNEPA 1997).
Nazlini Wash, nonperennial reaches, mouth to headwaters (miles included below)	ScHC EphWwHbt L&W	Not Assessed	C0, B0, H1, T0		Rangeland, riparian grazing, land disposal, road construction.	No new information since 1997 CWA 305(b) report (see NNEPA 1997).
Nazlini Wash, perennial reaches, mouth to headwaters 23.6 miles	ScHC* AgWS WwHbt* L&W	Partial (Evaluated)	C1, B0, H1, T0	Turbidity Fecal Coliform	Rangeland, riparian grazing, lack of riparian vegetation for shade.	
Tohtso Creek, confluence with Lukachukai Wash to headwaters 11 miles	*currently undesignated*		C1, B0, H1, T0		Rangeland, riparian grazing, upstream diversion, natural instability in headwaters, unpaved roads.	
Tsaile Creek, lake to headwaters 14.7 miles	PrHC*, ScHC* AgWS CwHbt* L&W	Partial (Monitored)	C2, B1, H2, T0	Turbidity Temperature DO Fecal Coliform	Rangeland, riparian grazing, lack of riparian vegetation for shade, exotic species, unpaved roads.	

Table 14 (cont). Chinle watershed streams assessment (supporting data is in Appendix D)

WATERBODY NAME SEGMENT WATERBODY SIZE	DESIGNATED USES * = INDICATES IMPAIRMENT	USE SUPPORT (ASSESSMENT CATEGORY)	DATA LEVEL (SEE APPENDIX B AND C; 0 = NO DATA, 1= LOW, 4= HIGH) C = PHYSICAL/CHEMICAL B = BIOASSESSMENT H = HABITAT ASSESSMENT T = TOXICOLOGICAL	USE SUPPORT STRESSOR(S)	POTENTIAL SOURCES OF STRESSOR (S)	ASSESSMENT COMMENTS
Tsaile Lake 260 acres	PrHC, ScHC CwHbt L&W	Not Assessed	C0, B0, H1, T0		Riparian grazing, recreation.	No new information since 1997 CWA 305(b) report (see NNEPA 1997).
Tyende Creek, mouth to headwaters 31.0 miles	ScHC EphWwHbt L&W	Not Assessed	C0, B0, H1, T0		Rangeland, riparian grazing.	No new information since 1997 CWA 305(b) report (see NNEPA 1997).
Walker Creek, nonperennial reaches, mouth to headwaters (miles included below)	ScHC EphWwHbt L&W	Not Assessed	C0, B0, H1, T0		Rangeland, natural sources (radon), abandoned uranium mines, sewage pond in floodplain, dredging by AZ highway department.	No new information since 1997 CWA 305(b) report (see NNEPA 1997).
Walker Creek, perennial reaches, mouth to headwaters 28.8 miles	PrHC* ScHC* AgWS CwHbt* WwHbt* L&W	Partial (Evaluated)	C1, B0, H1, T0	DO Fecal Coliform	Rangeland, riparian grazing, lack of riparian vegetation for shade, natural sources (radon), abandoned uranium mines.	
Wheatfields Creek, confluence with Canyon de Chelly to headwaters	*currently undesignated*		C2, B1, H2, T0		Rangeland, riparian grazing.	
Wheatfields Lake 218 acres	PrHC ScHC AgWS CwHbt L&W	Not Assessed	C0, B0, H1, T0		Rangeland, riparian grazing, recreation, road construction, land disposal.	No new information since 1997 CWA 305(b) report (see NNEPA 1997).
Whiskey Creek, mouth of Coyote Wash to headwaters 16.1 miles	PrHC* ScHC* AgWS CwHbt* L&W	Partial (Monitored)	C2, B1, H2, T0	Turbidity Temperature DO Fecal Coliform	Rangeland, riparian grazing, lack of riparian vegetation for shade, unpaved roads.	

- Coyote Wash, mouth to headwaters – NNEPA has two water quality monitoring stations on Crystal Creek, which is the headwaters of Coyote Wash. The use support assessment was based on physical/chemical and limited habitat data, as reflected in the data levels. Turbidity and fecal coliform values exceeded ScHC and EphWwHbt standards. We plan to sample benthic macroinvertebrates in Crystal Creek beginning spring of 2001.
- Laguna Creek, nonperennial reaches, mouth to headwaters – NNEPA has one water quality monitoring station on nonperennial reaches of this stream. Turbidity and temperature values exceeded EphWwHbt standards. Laguna Creek is near the Kayenta mine complex. USGS reportedly has an ongoing surface water monitoring program in the Black Mesa area, which includes Laguna Creek.
- Laguna Creek, perennial reaches, mouth to headwaters – NNEPA has one water quality monitoring station on perennial reaches of this stream. The use support assessment was based on limited physical/chemical and habitat data, as reflected in the data levels. Turbidity and fecal coliform values exceeded PrHC, ScHC, and WwHbt standards. Laguna Creek is near the Kayenta mine complex. USGS reportedly has an ongoing surface water monitoring program in the Black Mesa area, which includes Laguna Creek.
- Lukachukai Wash, perennial reaches, mouth to headwaters –NNEPA has two water quality monitoring station on perennial reaches of this stream, and one station on a tributary waterfall. The use support assessment was based on physical/chemical and limited habitat data, as reflected in the data levels. Turbidity, temperature, dissolved oxygen, and fecal coliform values exceeded PrHC, ScHC, and CwHbt standards. Also, a riparian study classified this stream segment as being in good condition with slightly eroded banks, dominant native riparian vegetation, and a high amount of soil binding herbaceous plants along the active (AGFD 1996).
- Nazlini Wash, perennial reaches, mouth to headwaters – NNEPA has one water quality monitoring station on perennial reaches of this stream. The use support assessment was based on limited physical/chemical and habitat data, as reflected in the data levels. Turbidity and fecal coliform values exceeded ScHC and WwHbt standards.
- Tsaile Creek, lake to headwaters – NNEPA has four water quality monitoring stations on this stream. We have also sampled two springs in the watershed. The use support assessment was based on physical/chemical data, habitat data, and limited biological data, as reflected in the data levels. Turbidity, temperature, dissolved oxygen, and fecal coliform values exceeded PrHC, ScHC, and CwHbt standards. Benthic macroinvertebrate sampling began in Tsaile Creek fall of 2000. A riparian study classified this stream segment as being in good condition with slightly eroded banks and a high amount of soil binding herbaceous plants along the active bank (AGFD 1996). Conversely, the Navajo Nation watershed prioritization study determined that the Tsaile Creek/Canyon del Muerto watershed was the most degraded watershed on the Navajo Nation (NRCS 1996). Heavy stream bottom siltation due to livestock trampling in and around the stream has also been reported (USFWS 1982).
- Walker Creek, perennial reaches, mouth to headwaters – NNEPA has one water quality monitoring station on perennial reaches of this stream. The use support assessment was based on limited physical/chemical and habitat data, as reflected in the data levels. Dissolved oxygen and fecal coliform values exceeded PrHC, ScHC, CwHbt, and WwHbt standards.
- Whiskey Creek, mouth of Coyote Wash to headwaters – NNEPA has two water quality monitoring stations on this stream reach. The use support assessment was based on physical/chemical data, habitat data, and limited biological data, as reflected in the data levels. Turbidity, temperature, dissolved oxygen, and fecal coliform values exceeded PrHC, ScHC, and CwHbt standards. Benthic macroinvertebrate sampling began in Whiskey Creek fall of 2000.

Serious soil erosion throughout the watershed has been reported as a result of timber harvest operations, logging roads, excessive grazing in the riparian area, and heavy snowmelt run-off (USFWS 1975 and USFWS 1982).

The following stream segment was determined to **not support** its designated uses:

- Lukachukai Wash, nonperennial reaches, mouth to headwaters – NNEPA has one water quality monitoring station on the mainstem, and three stations on small tributaries in the watershed. The use support assessment was based on limited physical/chemical and habitat data, as reflected in the data levels. Turbidity and fecal coliform values exceeded ScHC and EphWwHbt standards. Gross alpha measured in Big Cave Creek was approximately two times the L&W standard. Although there are several small abandoned uranium mines in the Lukachukai area, other small tributaries that were sampled did not exceed gross alpha standards. Dissolved aluminum measured near the NNDWR Lukachukai stream gage was almost an order of magnitude greater than the acute CwHbt standard. The field crew was unable to follow the standard operating procedure of filtering this sample in the field due to extremely high turbidity and malfunction of the pumping unit. The lab was therefore requested to filter the sample. Measurement errors may have occurred at the lab as a result.

Turbidity and fecal coliform were the most common use support stressors identified in the Chinle watershed assessment. Elevated levels of these two parameters are somewhat expected, given past forestry and current grazing landuse in the watershed. However, there are difficulties associated with these assessing these two parameters. High intensity precipitation events, common in the southwest, can lead to temporary elevations in turbidity. Turbidity criteria were developed in the east, where high intensity precipitation events are not frequent. The Arizona Department of Environmental Quality (ADEQ) has determined that temporary periods of high turbidity does not necessarily adversely affect biota in the stream. Therefore, ADEQ is considering abolishing their turbidity standard during the next triennial review (Patti Spindler, personal communication).

Fecal coliform is a challenging parameter to measure given the short holding time. Appendix D notes that several fecal coliform samples exceeded the holding time. NNEPA plans to switch to *E. coli* during our triennial review (which also has a short holding time) and possibly set up an agreement with Din⏏ College, Tsaile, AZ, to do microbiological analyses. In the future, NNEPA also plans obtain bacteriological samples for several consecutive days in order to calculate geometric means.

CHAPTER 4: WATER QUALITY MANAGEMENT PROGRAMS

4.1. CURRENT MANAGEMENT PROGRAMS/ PROJECTS

NNEPA WQ is and has been an active member of the Forestry ID Team that drafted the Programmatic Environmental Impact Statement / Navajo Ten-Year Forest Management Plan Alternative (NNFD and BIA 2000). NNEPA prepared the Water Quality Protection Guidelines section of the plan which established water quality protection zones around riparian areas, and details a variety of best management practices (BMPs) designed to control nonpoint source pollution from a variety of silviculture activities. These activities include planning, construction,

reconstruction, maintenance, reclamation, and planned abandonment of roads, skid trails, and landings; yarding; site preparation; servicing of equipment; disposal of refuse, litter, trash, and debris; and pesticide use (NNFD and BIA 2000).

In 1996, the Navajo Nation Watershed Prioritization Study (NRCS 1996) ranked eighteen locally identified priority watersheds based on natural resource preservation and restoration needs. The entire Canyon de Chelly watershed, which includes both arms of Canyon de Chelly National Monument and their headwaters, was ranked number one. Future study narrowed watershed planning to the Canyon del Muerto/Tsaile watershed based on intensity of landuse. Due to this ranking, the Natural Resource Conservation Service (NRCS), in cooperation with the Chinle Soil and Water Conservation District (SWCD), NNEPA WQ, Navajo Nation Division of Natural Resources, and the National Park Service, prepared a natural resource plan for the watershed (NRCS 2000). This plan details several feasible alternative measures that meet stated watershed goals, including practices for stream and watershed restoration, erosion control, irrigation improvements, wildlife habitat improvements, rangeland and forestland condition improvements, and protection of wetlands and riparian vegetation. NNEPA WQ plans to implement one recommended bank protection project and one road crossing/grade stabilization project in Canyon del Muerto utilizing FY2000 CWA Section 319 funds. A Memorandum of Agreement has been drafted between the National Park Service, Chinle SWCD, NRCS, and Navajo Nation as the first step in the project.

NNEPA WQ was a partner in NNDWR's Arizona Water Protection Fund Tsaile Creek Watershed Restoration Demonstration Project. NNDWR received this grant to design and implement six modest watershed restoration demonstrations in the Canyon del Muerto/Tsaile Creek watershed. A variety of simple and practical soil and water conservation techniques and concepts were developed and demonstrated. The project was completed in 2000.

NNEPA WQ plans to continue educating BIA Roads, Navajo Engineering and Construction Authority (NECA), Navajo Nation Department of Transportation, various Nation Nation standing committees, chapter officials, and students on the effects of poor road construction, improper road alignment, incorrect placement of culverts, and lack of road maintenance on the water quality of the Navajo Nation. We have hosted several workshops, presentations, and fieldtrips over the last five years to discuss the issue. NNEPA WQ will be utilizing FY2000 CWA Section 319 funds to install a variety of forest road BMPs as a partner in the on-going Asaayi Lake PL 93-566 project.

NNEPA WQ plans to continue to educating Navajo Nation Department of Agriculture, SWCDs, farmboards, various Nation Nation standing committees, chapter officials, and students on the effects of overstocking, poor livestock management, uncontrolled riparian grazing, and lack of rotational grazing management on the water quality of the Navajo Nation. We have hosted several workshops, presentations, and fieldtrips over the last five years to discuss the issue. NNEPA WQ applied for and received CWA Section 319 grant to address grazing concerns in Red Lake Valley through fencing, rotational grazing management, and controlled fire (tree thinning). NNEPA was an active partner in NNDWR's National Fish and Wildlife Foundation Asaayi Lake Restoration Demonstration Project. In 1997, a riparian exclosure was constructed as part of the project. The landusers agreed to rest the exclosure for two-years. NNEPA WQ provided photo monitoring, chemical and biological monitoring, and technical assistance. The project was completed in 1999.

4.2. RECOMMENDATIONS AND FURTHER ACTIONS

Since most sources of exceedences are due to nonpoint source activities, NNEPA WQ will continue to provide education, to implement restoration projects, and to instigate interdisciplinary solutions in water quality problems to the best of our technical and financial ability in Chinle watershed and the rest of the Navajo Nation. Previous Clean Water Act (CWA) reports from other states and tribes have cited the disparity between CWA requirements and USEPA funding allocations for Indian tribes (CEPA 1994, NMWQCC 1994). As the 1994 New Mexico Water Quality Control Commission report points out "funding set-asides for Indian tribes in the CWA puts tribes in direct competition with the states for the limited available funds. The funding provided to tribes is inadequate to develop or implement effective water quality programs. . . [Funding for tribes] should be in addition to, not in place of, monies allocated to the states" (NMWQCC 1994:11). Considering that the Navajo Nation is the largest American Indian Tribe in terms of population and geographic area in the United States, the disparity between the objectives and requirements of the CWA and funding provided to tribes to meet these objectives is particularly apparent.

NNEPA is currently in discussions with USEPA regarding the need for increased CWA Section 106 funding to adequately and comprehensively determine and address water quality concerns on the Navajo Nation. If granted, NNEPA would receive a pre-set target level funding each year, similar to a state, rather than have to compete with other Native American tribes for the yearly pool of tribal funding. This situation is warranted due to the size and increasing population of the Navajo Nation. Increased funding would allow NNEPA WQ to follow through on programs to which considerable planning has already been devoted, but which have not been implemented due to funding and staff limitations. Given adequate funding, the NNEPA WQ will continue to expand these programs by adequately staffing the following proposed sections: Monitoring and Assessment, Watershed Protection, Compliance and Regulation, Education Outreach and Operator Training, and Groundwater Protection.

Regarding monitoring and assessment, additional funding would allow the NNEPA WQ to expand current water chemistry monitoring program per the strategic monitoring plan; to expand into biological, physical, and toxicological monitoring per the latest USEPA CWA 305(b) guidance; and to prepare more comprehensive 305(b)-style water quality assessment reports (currently not required to be submitted by tribes). Additional biological, physical, and toxicological monitoring would increase the data levels reported in Table 14, and increase confidence in the accuracy of use support assessments. Regarding development and implementation of projects to protect and restore priority watersheds, additional funding would allow NNEPA WQ to develop comprehensive best management practices (BMP) guidance documentation for natural resource users, including individual landusers, chapters, Navajo Nation departments, and federal agencies; initiate development of locally-driven Watershed Restoration Action Strategies (WRAS) per the Clean Water Action Plan; and develop and implement several CWA Section 319 non-point source pollution control demonstration projects in priority watersheds on the Navajo Nation.

Additional funding would allow NNEPA to further expand our Western and Shiprock agency Water Quality offices. The geographic extent of the Navajo Nation and the magnitude of many of the water quality problems faced by the Tribe have led NNEPA to call for the establishment of separate water quality offices in Western and Eastern agencies. Expansion of the satellite offices corresponds to the Navajo Nation Council's Local Empowerment Initiative, which aims to decentralize government and make it more responsive to regional concerns.

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APPENDIX A.

LIST OF NON-CHINLE WATERSHED WATER QUALITY STATIONS SAMPLED FY2000

Table A-1. Non-Chinle watershed water quality stations sampled FY2000.

WATERBODY NAME DESIGNATED USES	WATERSHED	AGENCY STATION CODE	FY2000 SAMPLE DATES	COMMENTS
Bonito Creek, confluence with Black Creek to headwaters * *currently undesignated*	Upper Puerco River	NNEPA WQ 15BONITOCR02	07/18/00 09/05/00	Bonito Creek is a tributary of Black Creek (designated uses PrHC, ScHC, EphWwHbt, L&W)
Bowl (Asaayi) Creek, Asaayi Lake to headwaters PrHC, ScHC, AgWS, CwHbt, L&W	Upper Puerco River	NNEPA WQ 15ASAAYICR05	06/27/00 09/05/00	
Bowl Creek, East Fork * *currently undesignated*	Upper Puerco River	NNEPA WQ 15ASAAYIEA06	09/05/00	East Fork Bowl Creek is a tributary of Bowl Creek (designated uses are PrHC, ScHC, AgWS, CwHbt, L&W)
Captain Tom Wash, perennial reaches, mouth to headwaters ScHC, EphWwHbt, L&W	Chaco Wash	NNEPA WQ 06CAPTAINT02	07/18/00	
Chaco River, mouth of Dead Man's Wash to Navajo Nation boundary ScHC, EphWwHbt, L&W	Chaco Wash	NNEPA WQ 06CHACORIV03	09/19/00	
Eagle Nest Arroyo, confluence with San Juan River to headwaters * *currently undesignated*	Middle San Juan River	NNEPA WQ 10EAGLENES05	09/20/00	Eagle Nest Arroyo is a tributary of the San Juan River (perennial tributary drainages designated uses Dom, PrHC, ScHC, AgWS, CwHbt, L&W)
Gallegos Canyon, confluence with San Juan River to headwaters *currently undesignated	Upper San Juan River	NNEPA WQ 08GALLEGOS01	07/17/00 09/19/00	Gallegos Wash is a tributary of the San Juan River (perennial tributary drainages designated uses Dom, PrHC, ScHC, AgWS, CwHbt, L&W)
Kinlichee Creek, confluence with Pueblo Colorado River to headwaters *currently undesignated	Cottonwood Wash	NNEPA WQ 08KINLICHEE03	06/29/00 08/31/00	Kinlichee Creek is a tributary of Cottonwood Wash (designated uses ScHC, EphWwHbt, L&W)
McElmo Creek, confluence with San Juan River to headwaters *currently undesignated	McElmo Creek	NNEPA WQ 04MCELMOCR01	07/12/00 09/07/00	McElmo Creek is a tributary of the San Juan River (perennial tributary drainages designated uses Dom, PrHC, ScHC, AgWS, CwHbt, L&W)
Ojo Amarillo Canyon, confluence with San Juan River to headwaters *currently undesignated	Middle San Juan River	NNEPA WQ 10OJOAMARI04	07/13/00 09/20/00	Ojo Amarillo is a tributary of the San Juan River (perennial tributary drainages designated uses Dom, PrHC, ScHC, AgWS, CwHbt, L&W)
Pueblo Colorado Wash, confluence with Cottonwood Wash to headwaters *currently undesignated	Cottonwood Wash	NNEPA WQ 18PUEBLOCO02	07/11/00 09/05/00	Pueblo Colorado Wash is a tributary of Cottonwood Wash (designated uses ScHC, EphWwHbt, L&W)
Puerco River, within Navajo Nation boundary Dom, ScHC, EphWwHbt, L&W	Upper Puerco River	NNEPA WQ 15PUERCORI08	07/20/00 09/07/00	
Upper Fruitland Seep #3	Middle San Juan River	NNEPA WQ 10FRUSEEP03	09/25/00	The Upper Fruitland Seeps are in the Middle San Juan River watershed (nonperennial tributary drainages designated uses ScHC, EphWwHbt, L&W)

APPENDIX B.

HIERARCHY OF APPROACHES FOR EVALUATION OF AQUATIC LIFE USE ATTAINMENT (USEPA 1997)

Table 3-1. Hierarchy of Bioassessment Approaches for Evaluation of Aquatic Life Use Attainment Based on Resident Assemblages

Level of Info[a]	Technical Components	Spatial/ Temporal Coverage	Data Quality[b]	WBS Codes[c]
1	Visual observation of biota; reference conditions not used; simple documentation	Limited monitoring; extrapolations from other sites	Unknown or low precision and sensitivity; professional biologist not required	310, 320, 350, 322
2	One assemblage (usually invertebrates); reference conditions pre-established by professional biologist; biotic index or narrative evaluation of historical records	Limited to a single sampling; limited sampling for site-specific studies	Low to moderate precision and sensitivity; professional biologist may provide oversight	310, 320, 322, 350
3	Single assemblage usually the norm; reference condition may be site-specific, or composite of sites (e.g., regional); biotic index (interpretation may be supplemented by narrative evaluation of historical records)	Monitoring of targeted sites during a single season; may be limited sampling for site-specific studies; may include limited spatial coverage for watershed-level assessments	Moderate precision and sensitivity; professional biologist performs survey or provides training for sampling; professional biologist performs assessment.	310, 315, 320, 321, 330, 331, 350
4	Generally two assemblages, but may be one if high data quality; regional (usually based on sites) reference conditions used; biotic index (single dimension or multimetric index)	Monitoring during 1-2 sampling seasons; broad coverage of sites for either site-specific or watershed assessments; conducive to regional assessments using targeted or probabilistic design	High precision and sensitivity; professional biologist performs survey and assessment	310, 315, 320, 321, 330, 331, 340, 350

NOTE: Table is based on use in lotic systems. With some modification, these approaches would apply to other waterbody types.

[a] Level of information refers to rigor of bioassessment, where 1 = lowest and 4 = highest.

[b] Refers to ability of the ecological endpoints to detect impairment or to differentiate along a gradient of environmental conditions.

[c] WBS Assessment Type Codes from Table 1-1.

Table 3-2. Hierarchy of Habitat Assessment Approaches for Evaluation of Aquatic Life Use Attainment

Level Of Info[a]	Technical Components	Spatial/ Temporal Coverage	Data Quality[b]	WBS Codes[c]
1	Visual observation of habitat characteristics; no true assessment; documentation of readily discernable land use characteristics that might alter habitat quality; no reference conditions	Sporadic visits; sites are mostly from road crossings or other easy access	Unknown or low precision and sensitivity; professional scientist (biologist, hydrologist) not required	365
2	Visual observation of habitat characteristics and simple assessment; use of land use maps for characterizing watershed condition; reference condition pre-established by professional scientist	Limited to annual visits and non-specific to season; generally easy access; limited spatial coverage and/or site-specific studies	Low precision and sensitivity; professional biologist or hydrologist not involved or only correspondence	370
3	Visual-based habitat assessment using standard operating procedures (SOPs); may be supplemented with quantitative measurements of selected parameters; conducted with bioassessment; data on land use compiled and used to supplement assessment; reference condition used as a basis for assessment	Assessment during a single season usually the norm; spatial coverage may be limited or broad and commensurate with biological sampling; assessment may be regional or site-specific	Moderate precision and sensitivity; professional biologist or hydrologist performs survey or provides oversight and training	375
4	Assessment of habitat based on quantitative measurements of instream parameters, channel morphology, and floodplain characteristics; conducted with bioassessment; data on land use compiled and used to supplement assessment; reference condition used as a basis for assessment	Assessment during 1-2 seasons; spatial coverage usually broad and commensurate with biological sampling; assessment may be regional or site-specific	High precision and sensitivity; professional biologist or hydrologist performs survey and assessment	380

NOTE: Table is based on use in lotic systems. With some modification, these approaches would apply to other waterbody types.

[a] Level of information refers to rigor of habitat assessment, where 1 = lowest and 4 = highest.

[b] Refers to ability of the habitat endpoints to detect impairment or to differentiate along a gradient of environmental conditions.

[c] WBS Assessment Type Codes from Table 1-1.

Table 3-3. Hierarchy of Toxicological Approaches and Levels for Evaluation of Aquatic Life Use Attainment

Level of Info[a]	Technical Components	Spatial/ Temporal Coverage	Data Quality[b]	WBS Codes[c]
1	Any one of the following: • Acute or chronic WET • Acute ambient • Acute sediment	1-2 WET tests/yr or 1 ambient or sediment sample tested in a segment or site	Unknown/low; minimal replication used; laboratory quality or expertise unknown	510, 520, 530, 550
2	Any of the following: • Acute or chronic ambient • Acute sediment • Acute and chronic WET for effluent-dominated system	3-4 WET tests/yr or 2 ambient or sediment samples tested in a segment or site at different times	Low/moderate—little replication used within a site; laboratory quality or expertise unknown or low	510, 520, 530, 540, 550
3	Any of the following: • Acute and chronic WET for effluent-dominated system • Chronic ambient or acute or chronic sediment	Monthly WET tests or total of 3 tests based on samples collected in a segment at 3 different times	Moderate/high—replication used; trained personnel and good laboratory quality	510, 520, 540, 550
4	Both of the following: • Acute and chronic ambient and • Acute or chronic sediment	≥ 4 tests in total based on samples collected in a segment at 4 different times including low flow conditions	High—replication used; trained personnel and good laboratory quality	530, 540, 550

[a] Level of information refers to rigor of toxicity testing, where 1 = lowest and 4 = highest

[b] Refers to ability of the toxicity testing endpoints to detect impairment or to differentiate along a gradient of environmental conditions

[c] WBS Assessment Type Codes from Table 1-1.

Table 3-4. Hierarchy of Physical/chemical Data Levels for Evaluation of Aquatic Life Use Attainment

Level of Info[a]	Technical Components	Spatial/Temporal Coverage	Data Quality[c]	WBS Codes[d]
1	Any one of the following: • Water quality monitoring using grab water sampling • Water data extrapolated from an upstream or downstream station where homogeneous conditions are expected • Monitoring data >5 years old without further validation • Best professional judgment based on land use data, source locations	Low spatial and temporal coverage: • Quarterly or less frequent sampling with limited period of record (e.g., 1 day) • Limited data during key periods or at high or low flows (critical hydrological regimes)[b].	Unknown/ Low	210, 220, 230, 240, 850, 150, 130
2	Any one of the following: • Water quality monitoring using grab water sampling • Rotating basin surveys involving multiple visits or automatic sampling • Synthesis of existing or historical information on fish contamination levels • Screening models based on loadings data (not calibrated or verified).	Moderate spatial and temporal coverage: • Bimonthly or quarterly sampling during key periods (e.g., spring/ summer months • Fish spawning seasons, including limited water quality data at high and low flows • Short period of record over a period of days or multiple visits during a year or season.	Low/ Moderate	210, 220, 222, 230, 240, 242, 260, 810, 180
3	Any one of the following: • Composite or a series of grab water sampling used (diurnal coverage as appropriate) • Calibrated models (calibration data <5 years old).	Broad spatial and temporal (long-term, e.g., > 3 years) coverage of site with sufficient frequency and coverage to capture acute events: • Typically, monthly sampling during key periods (e.g., spring/ summer months, fish spawning seasons), multiple samples at high and low flows • Lengthy period of record (sampling over a period of months).	Moderate/ High	211, 222, 242, 250, 610
4	All of the following: • Water quality monitoring using composite or series or grab samples (diurnal coverage as appropriate) • Limited sediment quality sampling and fish tissue analyses at sites with high probability of contamination.	Broad spatial (several sites) and temporal (long-term, e.g., > 3 years) coverage of site with sufficient frequency and parametric coverage to capture acute events, chronic conditions, and all other potential P/C impacts • Monthly sampling during key periods (e.g., spring/summer months • Fish spawning seasons) including multiple samples at high and low flows • Continuous monitoring.	High	231, 242, 250

NOTE: Physical refers to physical water parameters (e.g., temperature, pH, dissolved oxygen, turbidity, color, conductivity)

[a] Level of information refers to rigor of physical/chemical sampling and analysis, where 1 = lowest and 4 = highest.

[b] Even a short period of record can indicate a high confidence of *impairment* based on P/C data; 3 years of data are not required to demonstrate impairment. For example, a single visit to a stream with severe acid mine drainage impacts (high metals, low pH) can result in high confidence of nonsupport. However, long-term monitoring may be needed to establish full support.

[c] Refers to ability of the physical/chemical endpoints to detect impairment or to differentiate along a gradient of environmental conditions.

[d] WBS Assessment Type Codes from Table 1-1.

APPENDIX C.

SUFFICIENT VS. INSUFFICIENT DATA DETERMINATION FOR CONTACT RECREATION AND DRINKING WATER USE DETERMINATION (MDEQ 1999)

MDMB

Sufficient Credible Data (SCD)

Sufficient Credible Data Support Table

Drinking Water

Level of Information	Technical Component	Spatial/Temporal Coverage	Data Quality	Data Currency
Insufficient Data	Probable impairments to drinking water were not measured. Impairments are inferred. Probable sources of impairment were not documented.	Limited temporal coverage (less than quarterly sampling for, 3 years.) Data not collected at critical times. Limited spatial coverage that does not adequately target probable impairments (e.g., one location). Limited water quality data with no exceedences of standards, however sediment data indicates contamination, and/or probable sources of impairment are located in the watershed.	Data precision and sensitivity is low or unknown. QC protocols not followed or indicate contamination. Detection limits are too high. Samples not properly preserved.	Data does not reflect current conditions.
Sufficient Credible Data	Total recoverable metals were measured. Total and dissolved metals were measured. Organic compounds were measured. Sampling and analysis includes sediment. Probable sources of impairment were documented.	Drinking water quality standards are exceeded. A sufficient number of parameters were analyzed. At least quarterly sampling or sampling sufficiently targets critical time periods for >2 years. Good spatial coverage or well targeted sampling location(s). Limited water quality data with no exceedences of standards; however, sediment data does not have elevated metals and/or organic compounds and there are no probable sources of impairment located in the watershed.	Data precision and sensitivity moderate. QA/QC protocols are followed. Low detection limits.	Data likely reflects current conditions. There have not been any significant changes in activities occurring in the watershed since the data was collected.

MDMP

Sufficient Credible Data (SCD)

Sufficient Credible Data Support Table

Contact Recreation -- for Lakes and Streams (Swimming & Boating

Level of Information	Technical Component	Spatial/Temporal Coverage	Data Quality	Data Currency
Insufficient Data	Observations of algae bloom, odors, turbidity, aesthetics, etc. without documentation. Observations made about flows or water levels without documentation. observations made concerning surface scums, pollution, toxins, etc. without documentation.	Very limited water chemistry or fecal coliform data. Data not collected at critical times such as during the summer. Limited spatial coverage that does not adequately target probable causes of impairments (e.g., one location.) Limited temporal cover.	Data precision and sensitivity is low or unknown. QA/QC protocols were not followed. Samples not properly collected or preserved; or exceed holding times. Poor documentation.	Data does not reflect current conditions.
Sufficient Credible Data	Observations of algae blooms, odors, turbidity, aesthetics, etc. were well documented. Documentation includes photos. Probable sources of impairment identified; probable causes of impairment measured or well documented (toxins, dewatering, etc.) Chlorophyll a data collected. Fecal coliform data collected. Information concerning beach closures. Sechii disk data (lakes). Long-time local residents provide similar historical perspectives regarding their observation of changes in water quality over time.	Good temporal coverage of observations, photo documentation, fecal coliform data, etc. Data and observations are targeted during the summer months. Good spatial coverage or well targeted sampling location(s). Limited water quality data or documentation; however, data indicates severe impairment.	Data precision and sensitivity moderate. QA/QC protocols are followed. Low detection limits.	It is likely that the data reflects current conditions. There have not been any significant changes in activities occurring in the watershed since the data was collected.

APPENDIX D.

CHINLE WATERSHED STREAM ASSESSMENT SUPPORTING DATA

Table D-1. Chinle watershed assessment supporting data.

WATERBODY NAME SEGMENT ID	AGENCY STATION CODE STATION DATES	PARAMETERS OF CONCERN	RANGE OF RESULTS (MEDIAN)	STANDARD	ASSOCIATED DESIGNATED USE	FREQUENCY OF STANDARD EXCEEDENCE	COMMENTS
Chinle Creek/ Chinle Wash, mouth of mouth of Canyon de Chelly 14080204-001X PrHC, ScHC, AgWS, EphWwHbt, L&W	NNEPA WQ 01CHINLEWA01 1999	Turbidity	>1000	50 NTUs	EphWwHbt	1 of 1	
	NNEPA WQ 01CHINLEWA02 2000	Turbidity Fecal Coliform	404 500	50 NTUs 200 CFU/100mL	EphWwHbt PrHC	1 of 1 1 of 1	FC exceedence – Measured in MPN/100mL; exceeded 6 hr holding time*.
Coyote Wash, mouth to headwaters 14080204-019 ScHC, EphWwHbt, L&W	NNEPA WQ 01CRYSTALC03 1995-2000	Turbidity	4.1-73.5 (12.5)	50 NTUs	EphWwHbt	1 of 9	
	NNEPA WQ 01CRYSTALC28 2000	Fecal Coliform	≥1600	400 CFU/100mL	ScHC	1 of 1	FC exceedence – Measured in MPN/100mL; exceeded 6 hr holding time*.
Laguna Creek, nonperennial reaches, mouth to headwaters 14080204-003N ScHC, EphWwHbt, L&W	NNEPA WQ 01LAGUNACR04 1999	Turbidity Temperature	143 32.4	50 NTUs 32.2 °C	EphWwHbt EphWwHbt	1 of 1 1 of 1	
Laguna Creek, perennial reaches, mouth to headwaters 14080204-003P PrHC, ScHC, AgWS, WwHbt, L&W	NNEPA WQ 01LAGUNACR25 2000	Turbidity Fecal Coliform	>1000 ≥1600	50 NTUs 200 CFU/100mL	EphWwHbt PrHC	1 of 1 1 of 1	FC exceedence – Measured in MPN/100mL; exceeded 6 hr holding time*.
Lukachukai Wash, nonperennial reaches, mouth to headwaters 14080204-026N ScHC, EphWwHbt, L&W	NNEPA WQ 01BIGCAVEC26 1998	Gross Alpha	32.96±2.77	15 pCi/L	L&W	1 of 1	Gross alpha was detected 1 of 1 times in a small tributary to Lukachukai Wash in amounts that exceed the L&W standards.
	NNEPA WQ 01LUKACHUK08 2000	Turbidity Fecal Coliform Aluminum, Dissolved	>1000 ≥1600 7200 ug/L	50 NTUs 400 CFU/100mL 750 ug/L	PrHC ScHC EphWwHbt	1 of 1 1 of 1 1 of 1	FC exceedence – Measured in MPN/100mL; exceeded 6 hr holding time*. Aluminum exceedence – Holding time was met; carbonate alkalinity reported. Aluminum was lab filtered due to excessive turbidity.
	NNEPA WQ 01SKINNYCR27 1998	Ok					
	NNEPA WQ 01SMALLCRE29 2000	Ok					

Table D-1 (cont). Chinle watershed assessment supporting data.

WATERBODY NAME SEGMENT ID	AGENCY STATION CODE STATION DATES	PARAMETERS OF CONCERN	RANGE OF RESULTS (MEDIAN)	STANDARD	ASSOCIATED DESIGNATED USE	FREQUENCY OF STANDARD EXCEEDENCE	COMMENTS
Lukachukai Wash, perennial reaches, mouth to headwaters 14080204-026P Dom, PrHC, ScHC, AgWS, CwHbt, L&W	NNEPA WQ 01LUKACHUK05 1995-2000	Turbidity Temperature DO Fecal Coliform	1.8-95.1 (13.7) 10.6-22.6 (20.4) 5.3-10.7 (8.0) 13-500 (97)	10 NTUs 20.0 °C 6.0 mg/L 200 CFU/100mL	CwHbt CwHbt CwHbt PrHC	3 of 6 1 of 6 1 of 6 1 of 5	FC exceedence – Measured in MPN/100mL; exceeded 6 hr holding time*.
	NNEPA WQ 01LUKACHUK06 1996-2000	Ok					Locals collect water from this tributary waterfall. Direct FC sampling of this tributary had 0 of 3 exceedences.
	NNEPA WQ 01LUKACHUK07 1997-2000	Turbidity Fecal Coliform	7.1-39.0 (17.7) 240	10 NTUs 200 CFU/100mL	CwHbt PrHC	3 of 4 1 of 1	FC exceedence – Measured in MPN/100mL; exceeded 6 hr holding time*.
Nazlini Wash, perennial reaches, mouth to headwaters 14080204-016P ScHC, AgWS, WwHbt, L&W	NNEPA WQ 01NAZLINIC09 1999-2000	Turbidity Fecal Coliform	5.6->1000 17-1600 (23)	50 NTUs 400 CFU/100mL	WwHbt ScHC	2 of 3 1 of 2	FC exceedence – Measured in MPN/100mL; exceeded 6 hr holding time*.
Tohtso Creek, confluence with Lukachukai Wash to headwaters 14080204-026T *currently undesignated*	NNEPA WQ 01TOHTSOCR17 1995-2000	Turbidity Temperature Fecal Coliform	0.7-512 (8.3) 6.1-24.8 (17.9) 1-510 (28)	na		na	
Tsaile Creek, lake to headwaters 14080204-023A PrHC, ScHC, AgWS, CwHbt, L&W	NNEPA WQ 01SPRINGTS10 1997	Ok					
	NNEPA WQ 01SPRINGTS15 1996-1997	Ok					
	NNEPA WQ 01TSAILECR11 1996-2000	DO	5.6-10.7 (6.3)	6.0 mg/L	CwHbt	2 of 7	Benthic macroinvertebrate sampling began Fall 2000.
	NNEPA WQ 01TSAILECR12 1996-2000	Turbidity Temperature DO Fecal Coliform	6.8->1000 (28.6) 3.6-26.6 (16.6) 5.7-9.4 (7.5) 8 - ≥1600	10 NTUs 20.0 °C 6.0 mg/L 200 CFU/100mL	CwHbt CwHbt CwHbt PrHC	8 of 10 1 of 10 2 of 9 2 of 5	1 of 2 FC exceedences – Measured in MPN/100mL; exceeded 6 hr holding time*.
	NNEPA WQ 01TSAILECR13 2000	Turbidity	70.8	10 NTUs	CwHbt	1 of 1	
	NNEPA WQ 01TSAILETR16 1995	Turbidity Temperature DO	2.1-26.4 11.3-21.9 (20.0) 5.3, 5.3	10 NTUs 20.0 °C 6.0 mg/L	CwHbt CwHbt CwHbt	1 of 2 1 of 3 2 of 2	
Walker Creek, perennial reaches, mouth to headwaters 14080204-027P PrHC, ScHC, AgWS, CwHbt, WwHbt, L&W	NNEPA WQ 01TOHCHINL14 1995	DO Fecal Coliform	3.6 230	6.0 mg/L 200 CFU/100mL	CwHbt PrHC	1 of 1 1 of 1	

Table D-1 (cont). Chinle watershed assessment supporting data.

WATERBODY NAME SEGMENT ID	AGENCY STATION CODE STATION DATES	PARAMETERS OF CONCERN	RANGE OF RESULTS (MEDIAN)	STANDARD	ASSOCIATED DESIGNATED USE	FREQUENCY OF STANDARD EXCEEDENCE	COMMENTS
Wheatfields Creek, confluence with Canyon de Chelly to headwaters 14080204-018A *currently undesignated*	NNEPA WQ 01WHEATFIE18 1995-2000	Temperature Fecal Coliform	7.3-22.0 (17.6) 1-500 (95)	na	na	na	Benthic macroinvertebrate sampling began Fall 2000.
	NNEPA WQ 01WHEATFIE19 1995-1998	Turbidity	4.0-18.9 (10.1)	na	na	na	
	NNEPA WQ 01WHEATFIE20 1997	Turbidity	27.7	na	na	na	
	NNEPA WQ 01WHEATFIE21 2000	Turbidity	31.4	na	na	na	
	NNEPA WQ 01WHEATFIE22 2000	Turbidity	32.6	na	na	na	
Whiskey Creek, mouth of Coyote Wash to headwaters 14080204-020 PrHC, ScHC, AgWS, CwHbt, L&W	NNEPA WQ 01WHISKEYC23 1995-2000	Turbidity DO Fecal Coliform	1.0-31.0 (3.3) 5.8-9.6 (7.1) 6-300 (120)	10 NTUs 6.0 mg/L 200 CFU/100mL	CwHbt CwHbt PrHC	1 of 11 1 of 10 1 of 5	FC exceedence – Measured in MPN/100mL; exceeded 6 hr holding time*. Benthic macroinvertebrate sampling began Fall 2000.
	NNEPA WQ 01WHISKEYC24 1995-2000	Turbidity Temperature Fecal Coliform	3.5-49.4 (13.4) 19.3-29 (25.4) 1-300 (6)	10 NTUs 20.0 °C 200 CFU/100mL	CwHbt CwHbt PrHC	3 of 5 4 of 5 1 of 3	FC exceedence – Measured in MPN/100mL; exceeded 6 hr holding time*.

NOTES: * Standard Methods (20th Edition) Section 9000 allows 24 hours holding time for non-compliance fecal coliform testing.